PB-239 549

ALTOONA LAKE, EAU CLAIRE COUNTY, WISCONSIN

Pacific Northwest Environmental Research Laboratory

Prepared for:

National Environmental Research Center
Wisconsin National Guard
Wisconsin Department of Natural Resources

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivded according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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REPORT

ON

ALTOONA LAKE

EAU CLAIRE COUNTY

WISCONSIN

EPA REGION V

WORKING PAPER No. 30

WITH THE COOPERATION OF THE

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

AND THE

WISCONSIN NATIONAL GUARD

OCTOBER, 1974

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Wisconsin Department of Natural Resources for professional involvement and to the Wisconsin National Guard for conduct of the tributary sampling phase of the Survey.

Francis H. Schraufnagel, Acting Assistant Director, and Joseph R. Ball of the Bureau of Water Quality, and Donald R. Winter, Lake Rehabilitation Program, provided invaluable lake documentation and counsel during the Survey. Central Office and District Office personnel of the Department of Natural Resources reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper series.

Major General James J. Lison, Jr., the Adjutant General of Wisconsin, and Project Officer CW-4 Donald D. Erickson, who directed the volunteer efforts of the Wisconsin National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

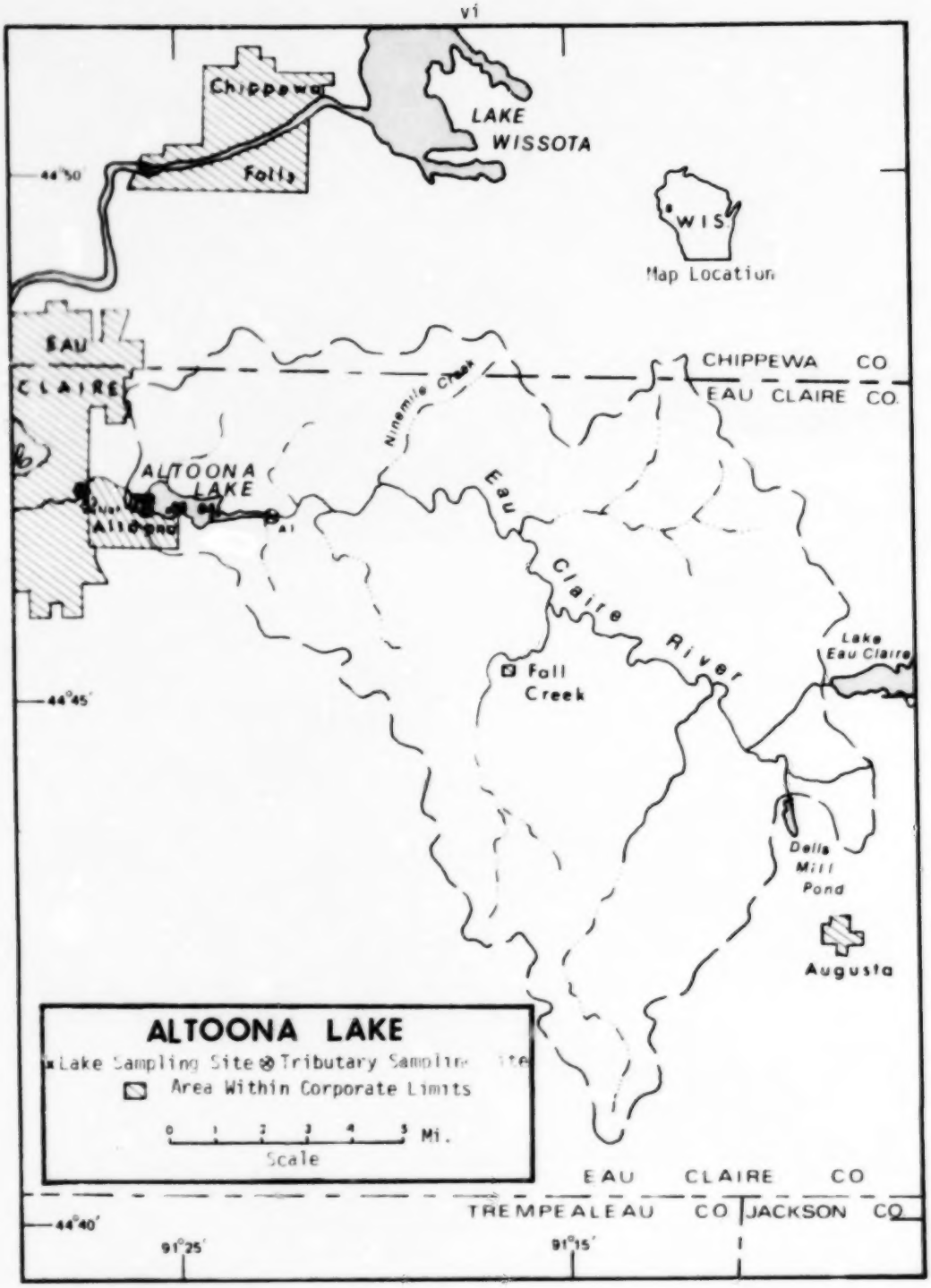
NATIONAL EUTROPHICATION SURVEY

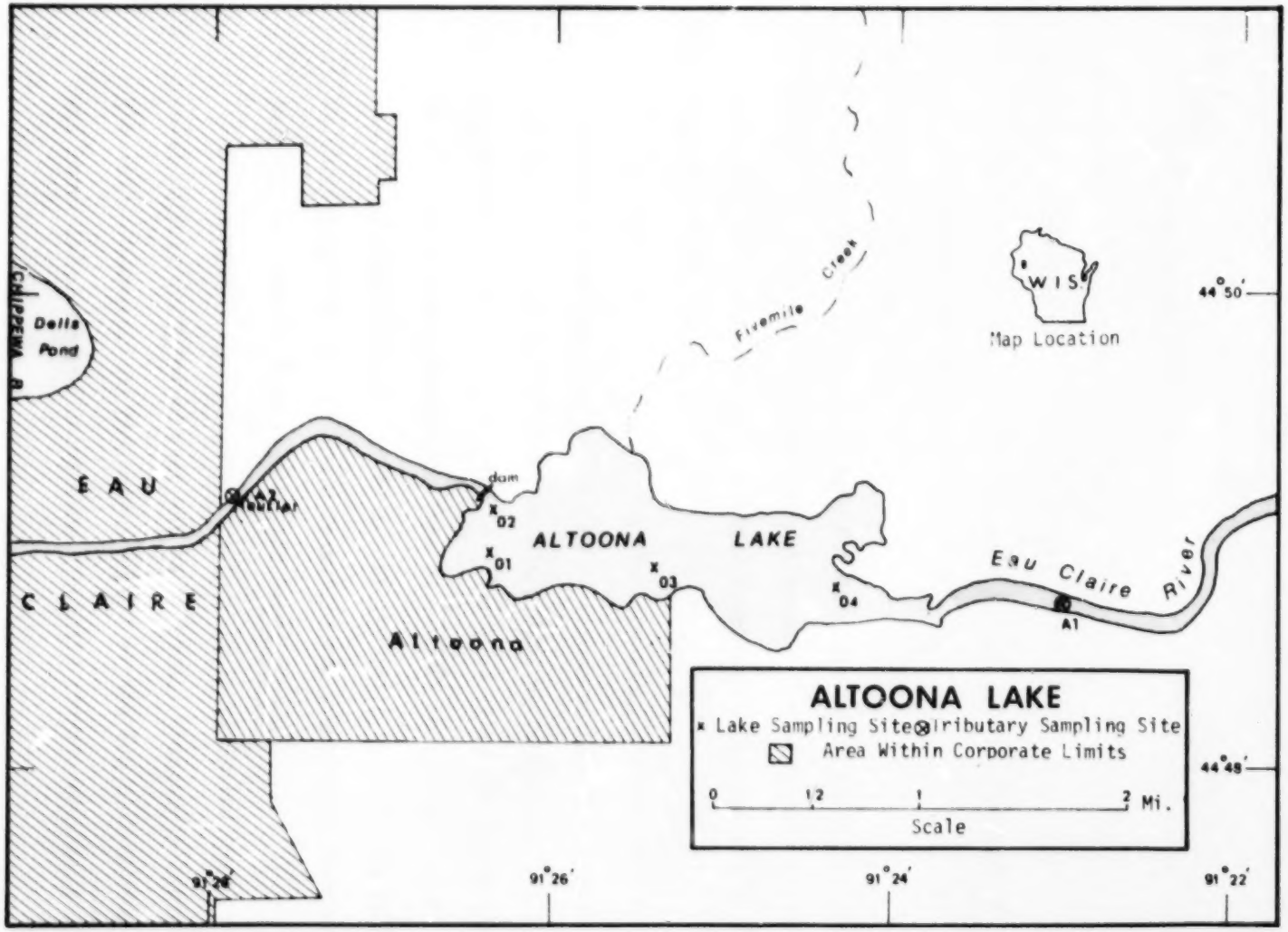
STUDY LAKES

STATE OF WISCONSIN

LAKE NAME	COUNTY
Altoona	Eau Claire
Beaver Dam	Barron
Beaver Dam	Dodge
Big Eau Pleine	Marathon
Browns	Racine
Butte des Morts	Winnebago
Butternut	Price, Ashland
Castle Rock Flowage	Juneau
Como	Walworth
Crystal	Vilas
Delavan	Walworth
Eau Claire	Eau Claire
Elk	Price
Geneva	Walworth
Grand	Green Lake
Green	Green Lake
Kegonsa	Dane
Koshkonong	Jefferson, Rock, Dane
Lac La Belle	Waukesha
Long	Price
Middle	Walworth
Nagawicka	Waukesha
Oconomowoc	Waukesha
Okauchee	Waukesha
Petenwell Flowage	Juneau
Pewaukee	Waukesha
Pigeon	Waupaca
Pine	Waukesha
Poygan	Winnebago, Waushara
Rock	Jefferson
Rome Pond	Jefferson, Waukesha
Round	Waupaca
Shawano	Shawano

LAKE NAME	COUNTY
Sinnissippi	Dodge
Swan	Columbia
Tainter	Dunn
Tichigan	Racine
Townline	Oneida
Trout	Vilas
Wapogassett	Polk
Wausau	Marathon
Willow	Oneida
Winnebago	Winnebago, Fond Du Lac, Calumet
Wisconsin	Columbia
Wissota	Chippewa
Yellow	Burnett


Chippewa Falls
LAKE WISSOTA
44°50'
WIS
Map Location
EAU CLAIRE
CHIPPEWA CO
EAU CLAIRE CO.
Ninemile Creek
ALTOONA LAKE
Eau Claire River
Lake Eau Claire
Fall Creek
44°45'
Dells Mill Pond
Augusta
ALTOONA LAKE
Lake Sampling Site
Tributary Sampling Site
Area Within Corporate Limits
0 1 2 3 4 5 Mi.
Scale
EAU CLAIRE CO
TREMPEALEAU CO
JACKSON CO
44°40'
91°25'
91°15'


Dells Pond
CHIPPEWA R.
EAU
CLAIRE
dam
ALTOONA LAKE
Eau Claire River
Altoona
X02
X01
X03
X04
A1
Fixemile Creek
WIS
Map Location
44°50'
44°48'
91°28'
91°26'
91°24'
91°22'
ALTOONA LAKE
x Lake Sampling Site ⊗ Tributary Sampling Site
Area Within Corporate Limits
0 1/2 1 2 Mi.
Scale

ALTOONA LAKE

STORET NO. 5502

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate Altoona Lake is eutrophic. Records of others support this conclusion.

B. Rate-Limiting Nutrient:

Algal assay results indicate Altoona Lake was nitrogen limited at the time the assay sample was collected. The lake data indicate nitrogen limitation during the other sampling periods as well.

C. Nutrient Controllability:

1. Point sources--During the sampling year, Altoona Lake received a total phosphorus load at a rate more than four times the rate proposed by Vollenweider (in press) as "dangerous"; i.e., a eutrophic rate (see page 14). Of that load it is estimated that point sources contributed less than 2%, and it is unlikely that control of phosphorus at any or all of the point sources known to be impacting Altoona Lake would result in any significant improvement in the trophic condition of the lake.

2. Non-point sources (see page 14)--It is estimated that non-point sources contributed over 98% of the total phosphorus load to the lake. However, the phosphorus export of the Eau Claire River was about twice that of unimpacted Wisconsin streams elsewhere and

indicate underestimation of the point-source load. Nonetheless, even if the Eau Claire River load was reduced to half the present load, the loading rate to Altoona Lake would still be more than twice the eutrophic rate.

II. INTRODUCTION

Altoona Lake is an impoundment of the Eau Claire River in the lower Chippewa River Drainage of northwest Wisconsin. The 27-foot dam was constructed in 1939.

The primary uses of the lake are recreational. Swimming, boating, and fishing are among these uses. Game fish present in the lake include walleyes, largemouth bass, and panfish, but carp are reportedly a problem (Sather and Threinen, 1964).

Although most of the shoreline is privately owned, public access is provided. One resort provides services. Other uses of the lake are flood control and low-flow augmentation.

About 80% of the drainage is in agricultural use, and most of the remainder is wooded. The main agricultural uses are dairying and the production of canning crops.

III. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry:

1. Surface area: 840 acres.
2. Mean depth: 7 feet.
3. Maximum depth: 25 feet.
4. Volume: 4,880 acre/feet.
5. Mean hydraulic retention time: 5 days.

B. Tributary and Outlet:
(See Appendix A for flow data)

1. Tributaries -

Name	Drainage area*	Mean flow*
Eau Claire River	798.0 mi^2	557.4 cfs
Minor tributaries & immediate drainage -	14.7 mi^2	11.6 cfs
Totals	812.7 mi^2	569.0 cfs

2. Outlet -

Eau Claire River	814.0 mi^2**	569.0 cfs

C. Precipitation†:

1. Year of sampling: 46.4 inches.
2. Mean annual: 31.0 inches.

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* Drainage areas are accurate within ±0.5%; mean daily flows are accurate within ±40%: mean monthly flows are accurate within ±35%; and normalized monthly flows are accurate within ±35%.

** Includes area of lake.

† See Working Paper No. 1, "Survey Methods".

IV. LAKE WATER QUALITY SUMMARY

Altoona Lake was sampled three times at station 1 and twice at the other three stations during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from the stations and from a number of depths at each station (see map, page vi). During each visit, a single depth-integrated (15 feet or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the last visit, a single five-gallon depth-integrated sample was composited from the four stations for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 25 feet at station 1, 20 feet at station 2, 12 feet at station 3, and 20 feet at station 4.

The results obtained are presented in full in Appendix B, and the data for the fall sampling period, when the lake was essentially well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix B.

A. Physical and chemical characteristics:

Parameter	Minimum	Mean	Median	Maximum
		FALL VALUES (11/05/72)		
Temperature (Cent.)	5.0	5.1	5.0	5.2
Dissolved oxygen (mg/l)	10.9	11.1	11.0	11.2
Conductivity (μmhos)	75	75	75	80
pH (units)	7.0	7.1	7.1	7.2
Alkalinity (mg/l)	10	14	16	17
Total P (mg/l)	0.081	0.106	0.106	0.123
Dissolved P (mg/l)	0.038	0.049	0.049	0.059
NO_2 + NO_3 (mg/l)	0.320	0.364	0.360	0.400
Ammonia (mg/l)	0.130	0.153	0.160	0.180
		ALL VALUES		
Secchi disc (inches)	15	26	24	48

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
06/26/72	1. Melosira	1,501
	2. Fragilaria	496
	3. Dinobryon	174
	4. Nitzschia	161
	5. Anabaena	161
	6. Synedra	107
	Other genera	255
	Total	2,855
08/20/72	1. Anabaena	11,982
	2. Synedra	10,360
	3. Chroococcus	5,676
	4. Melosira	2,613
	Other genera	7,477
	Total	40,360
11/05/72	1. Dinobryon	2,259
	2. Flagellates	1,476
	3. Polycystis	693
	4. Navicula	572
	5. Nitzschia	241
	Other genera	1,867
	Total	7,108

2. Chlorophyll a -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll a (µg/l)
06/26/72	01	10.8
08/27/72	01	31.3
	02	22.1
	03	24.3
	04	27.4
11/05/72	01	2.2
	02	2.0
	03	1.9
	04	2.1

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.046	0.363	9.4
0.006 P	0.052	0.363	9.1
0.012 P	0.058	0.363	9.1
0.024 P	0.070	0.363	9.7
0.060 P	0.106	0.363	9.1
0.060 P + 10.0 N	0.106	10.363	53.2
10.0 N	0.046	10.363	18.5

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates the potential primary productivity of Altoona Lake was high at the time the sample was collected. Also, the lack of response to increasing levels of orthophosphorus, until nitrogen was also added, indicates the lake was nitrogen limited. Note that the addition of only nitrogen

resulted in a yield significantly greater than that of the control.

The lake data indicate nitrogen limitation during the other sampling periods as well. Nitrogen to phosphorus ratios were 10 to 1 or less; i.e., nitrogen limitation would be expected.

D. Trophic Condition:

Survey data and the records of others indicate that Altoona Lake is eutrophic. A former resident reports that heavy algal blooms were common during the summer months and that odor problems were associated with the blooms at times (McCrady, 1974). Wisconsin records show that the lake has been chemically treated for algae control nearly every year since 1961 (Lueschow, 1972).

Of the 46 Wisconsin lakes included in the Survey, 30 had less mean total phosphorus, 32 had less mean inorganic nitrogen, 26 had less mean chlorophyll a, and 37 had greater mean Secchi disc transparency.

V. NUTRIENT LOADINGS
(See Appendix C for data)

For the determination of nutrient loadings, the Wisconsin National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page vii), except for the high runoff months of April and May, when two samples were collected, and the colder months of the year when ice cover prevented sampling at site A-1. Sampling was begun in September, 1972, and was completed in August, 1973.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Wisconsin District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, the Eau Claire River nutrient loads were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Because no unimpacted streams were sampled in the Altoona Lake basin, nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were calculated using the mean concentrations in unimpacted Paint Creek, tributary to nearby Lake Wissota, and the mean ZZ flow.

The effluent of the Village of Fall Creek wastewater treatment plant was not sampled during the Survey. Nutrient loads attributed to this source are based on the estimated contributing population and annual per capita contributions of 2.5 lbs of phosphorus and 7.5 lbs of nitrogen.

* See Working Paper No. 1.

In the following loading tables, the nutrient loads given for the Eau Claire River inlet are the loads measured at A-1 minus the estimated Fall Creek STP loads.

A. Waste Sources:

1. Known municipal -

Name	Pop.* Served	Treatment	Mean** Flow (mgd)	Receiving Water
Fall Creek	839	trickling filter	0.084	Fall Creek

2. Known industrial† -

Name	Product	Treatment	Mean Flow (mgd)	Receiving Water
Fall Creek Coop. Creamery Company	dairy products	Fall Creek STP	?	Fall Creek

* 1970 Census.
** Estimated at 100 gal/capita/day.
† McKersie, et al., 1971.

B. Annual Total Phosphorus Loading -

1. Inputs -

Source	lbs P/ yr	% of total
a. Tributaries (non-point load) -		
Eau Claire River	144,930	97.2
b. Minor tributaries & immediate drainage (non-point load) -	1,940	1.3
c. Known municipal STP's -		
Fall Creek	2,100	1.4
d. Septic tanks* -	80	<0.1
e. Known industrial -		
Fall Creek Coop Creamery Co.	(Fall Creek STP)	
f. Direct precipitation** -	130	0.1
Total	149,180	100.0

2. Outputs -

Lake outlet - Eau Claire River 161,110

3. Net annual P loss - 11,930 pounds

* Estimated 110 dwellings and one resort on shoreline; see Working Paper No. 1.
** See Working Paper No. 1.

C. Annual Total Nitrogen Loading -

1. Inputs -

Source	lbs N/ yr	% of total
a. Tributaries (non-point load) -		
Eau Claire River	1,564,700	96.3
b. Minor tributaries & immediate drainage (non-point load) -	42,750	2.6
c. Known municipal STP's -		
Fall Creek	7,890	0.4
d. Septic tanks* -	2,820	0.2
e. Known industrial -		
Fall Creek Coop. Creamery Co.	(Fall Creek STP)	
f. Direct precipitation** -	8,090	0.5
Total	1,626,250	100.0

2. Outputs -

Lake outlet - Eau Claire River 1,851,220

3. Net annual N loss - 224,970 pounds

* Estimated 110 dwellings and one resort on shoreline; see Working Paper No. 1.

** See Working Paper No. 1.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	lbs P/mi^2/yr	lbs N/mi^2/yr
Eau Claire River	182	1,961

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (in press). Essentially, his "dangerous" rate is the rate at which the receiving waters would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

	Total Phosphorus		Total Nitrogen	
Units	Total	Accumulated	Total	Accumulated
lbs/acre/yr	177.6	loss*	1,936.0	loss*
grams/m^2/yr	19.91	-	217.0	-

Vollenweider loading rates for phosphorus (g/m^2/yr) based on mean depth and mean hydraulic retention time of Altoona Lake:

"Dangerous" (eutrophic rate)	4.20
"Permissible" (oligotrophic rate)	2.10

* During the sampling year, there appeared to be a significant loss of both nitrogen and phosphorus from Altoona Lake. This would not be expected even with the very short retention time of five days. Neither the available information on Altoona Lake and the drainage nor the Survey data provide an explanation for this unlikely imbalance, but it is noted that the mean concentrations of both phosphorus and nitrogen were higher at the outlet sampling site than at the inlet site. This, too, would not be expected.

VI. LITERATURE REVIEWED

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TRIBUTARY FLOW INFORMATION FOR WISCONSIN 9/30/74

LAKE CODE 5502 ALTOONA LAKE

TOTAL DRAINAGE AREA OF LAKE 814.00

TRIBUTARY	SUB-DRAINAGE AREA	NORMALIZED FLOWS JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
550241	798.00	180.00	160.00	1100.00	1600.00	900.00	900.00	380.00	270.00	280.00	320.00	370.00	220.00	557.40
550242	814.00	201.00	161.00	1104.00	1637.00	904.00	924.00	392.00	281.00	291.00	331.00	381.00	241.00	568.96
550277	16.00	3.90	1.10	22.00	32.00	20.00	20.00	7.70	5.40	5.40	6.50	7.50	4.60	11.56

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 814.00
SUM OF SUB-DRAINAGE AREAS = 814.00

TOTAL FLOW IN = 6818.49
TOTAL FLOW OUT = 6814.00

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
550241	9	72	1400.00	23	1100.00				
	10	72	1400.00	15	800.00				
	11	72	1400.00	12	1500.00				
	12	72	330.00	9	430.00				
	1	73	780.00						
	2	73	320.00	10	300.00				
	3	73	4800.00	10	5100.00				
	4	73	1500.00	14	670.00				
	5	73	3200.00	2	10000.00	30	1400.00		
	6	73	460.00	17	280.00				
	7	73	120.00	18	95.00				
	8	73	140.00	12	140.00				
550242	9	72	1500.00	23	1100.00				
	10	72	1400.00	15	820.00				
	11	72	1400.00	12	1600.00				
	12	72	340.00	9	440.00				
	1	73	800.00						
	2	73	330.00	10	320.00				
	3	73	4800.00	10	5200.00				
	4	73	1500.00	14	680.00				
	5	73	3300.00	2	10400.00	30	1400.00		
	6	73	470.00	17	280.00				
	7	73	120.00	18	97.00				
	8	73	140.00	12	140.00				
550277	9	72	72.00	23	54.00				
	10	72	38.00	15	22.00				
	11	72	66.00	12	73.00				
	12	72	8.20	9	10.00				
	1	73	0.60						
	2	73	0.20	10	0.20				
	3	73	36.00	10	38.00				
	4	73	160.00	14	72.00				
	5	73	170.00	2	1100.00	30	70.00		
	6	73	24.00	17	14.00				
	7	73	4.20	18	3.40				
	8	73	3.70	12	36.00				

APPENDIX B

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 74/09/30

550201
44 49 00.0 091 27 00.0
ALTOONA LAKE
55035 WISCONSIN

11EPALES 2111202
6 0016 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/26	14	20 0000	21.0	10.1	48	105	7.60	34	0.070	0.070	0.032	0.024
	14	20 0015	19.2	7.6		110	7.50	35	0.100	0.070	0.034	0.024
	14	20 0025	19.1	7.1		110	7.30	37	0.100	0.070	0.033	0.025
72/08/27	08	55 0000			27	89	7.00	29	0.130	0.200	0.092	0.027
	08	55 0004	20.4	6.5		85	7.00	28	0.130	0.190	0.065	0.023
	08	55 0012	20.3	7.9		83	7.00	31	0.140	0.210	0.065	0.021
72/11/05	13	35 0000			22	80	7.10	10K	0.350	0.170	0.081	0.040
	13	35 0004	5.2	11.2		75	7.10	10K	0.320	0.130	0.086	0.040
	13	35 0012	5.1	11.2		75	7.20	10K	0.340	0.130	0.094	0.038

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/26	14	20 0000	10.8J
72/08/27	08	55 0000	31.3J
72/11/05	13	35 0000	2.2J

K VALUE KNOWN TO BE LESS THAN INDICATED

J VALUE KNOWN TO BE IN ERROR

STORET RETRIEVAL DATE 74/09/30

550202
44 49 00.0 091 27 00.0
ALTOONA LAKE
55035 WISCONSIN

11EPALES 2111202
6 0024 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/08/27	09	25 0000			33	81	7.10	26	0.290	0.130	0.092	0.040
	09	25 0004	19.3	7.6		85	7.10	27	0.300	0.140	0.067	0.040
72/11/05	13	20 0000			18	75	7.10	16	0.360	0.160	0.108	0.045
	13	20 0004	5.0	10.9		75	7.10	16	0.360	0.160	0.123	0.050
	13	20 0014	5.0	10.9		75	7.20	17	0.340	0.140	0.113	0.048
	13	20 0020	5.0	10.9		75	7.20	16	0.360	0.160	0.106	0.059

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/08/27	09	25 0000	22.1J
72/11/05	13	20 0000	2.0J

J VALUE KNOWN TO BE [illegible]

19A

STORET RETRIEVAL DATE 74/09/30

550203
44 49 00.0 091 27 00.0
ALTOONA LAKE
55035 WISCONSIN

11EPALES
6

2111202
0015 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/08/27	09 05	0000			24	87	7.00	28	0.130	0.270	0.088	0.028
	09 05	0004	20.6	6.3		84	7.00	28	0.120	0.210	0.054	0.028
	09 05	0012	20.4	8.4		100	7.00	26	0.130	0.240	0.091	0.025
72/11/05	13 45	0000			17	75	7.10	17	0.370	0.140	0.103	0.044
	13 45	0004	5.1	11.2		75	7.20	17	0.370	0.180	0.103	0.057
	13 45	0012	5.0	11.0		75	7.20	10K	0.360	0.150	0.106	0.049

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/08/27	09 05	0000	24.3J
72/11/05	13 45	0000	1.9J

K VALUE KNOWN TO BE LESS THAN INDICATED

J VALUE ESTIMATED TO BE LESS THAN

20

STORET RETRIEVAL DATE 74/09/30

550204
44 49 00.0 091 27 00.0
ALTOONA LAKE
55035 WISCONSIN

11EPALES
6

2111202
0012 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/08/27	08	35 0000			30	87	6.90	29	0.120	0.210	0.085	0.030
	08	35 0004	20.5	6.4		85	6.90	29	0.120	0.190	0.093	0.028
	08	35 0015	20.3	5.7		86	6.90	76	0.400	0.140	0.116	0.095
	08	35 0020	20.0	5.5		88	6.90	74	0.400	0.120	0.118	0.097
72/11/05	13	05 0000			15	75	7.10	16	0.400	0.160	0.114	0.056
	13	05 0004	5.1	11.2		75	7.00	15	0.400	0.150	0.123	0.055
	13	05 0008	5.0	11.0		75	7.00	15	0.400	0.160	0.123	0.055

21A

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/08/27	08	35 0000	27.4J
72/11/05	13	05 0000	2.1J

J VALUE KNOWN TO BE IN ERROR

APPENDIX C

TRIBUTARY DATA

STORET RETRIEVAL DATE 74/10/03

55024I L5550241
44 48 30.0 091 23 00.0
EAU CLAIRE RIVER
55091 15 CHIPPEWA FALL
T/ALTOONA LAKE
ENDOF TRAIL OFF PHESANT RD
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/23	10 30		0.340	1.200	0.370	0.072	0.170
72/10/15			0.370	1.000	0.115	0.042	0.115
72/11/12	09 40		0.330	1.600	0.056	0.046	0.098
72/12/09			0.280	0.570	0.052	0.032	0.063
73/03/10	10 30		0.520	2.000	0.610	0.126	0.250
73/03/31	09 00		0.480	0.640	0.023	0.044	0.075
73/04/14			0.189	1.620	0.075	0.035	0.110
73/05/02	11 30		0.015	0.575	0.037	0.027	0.070
73/05/30	10 55		0.210	0.660	0.033	0.037	0.120
73/06/17	09 30		0.480	0.910	0.260	0.033	0.165
73/07/18	16 00		0.052	0.960	0.140	0.025	0.067
73/08/12			0.410	1.230	0.092	0.110	0.230

STORET RETRIEVAL DATE 74/10/02

5502A2 L5502A2
44 50 00.0 091 28 00.0
EAU CLAIRE RIVER
55 15 CHIPPEWA FALL
O/ALTOONA LAKE
N BANK UNDR RR BRDG ABOV OTTER CRK CONFL
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/09/23	09 40		0.310	0.900	0.273	0.066	0.147
72/10/15			0.400	2.200	0.320	0.044	0.115
72/11/12	09 00		0.320	0.800	0.042	0.036	0.105
72/12/09			0.650	0.920	0.062	0.048	0.105
73/01/21	09 15		0.730	0.540	0.091	0.050	0.075
73/02/10			0.730	0.685	0.115	0.056	0.095
73/03/10			0.540	2.200	0.660	0.120	0.290
73/03/31	08 00		0.480	0.750	0.066	0.046	0.080
73/04/14			0.198	1.680	0.120	0.037	0.105
73/05/02			0.310	1.600	0.092	0.075	0.245
73/05/30	10 00		0.210	1.700	0.038	0.036	0.080
73/06/17	09 00		0.042	0.860	0.110	0.008	0.115
73/07/18	15 30		0.046	1.400	0.147	0.052	0.165
73/08/12			0.370	1.100	0.067	0.084	0.220